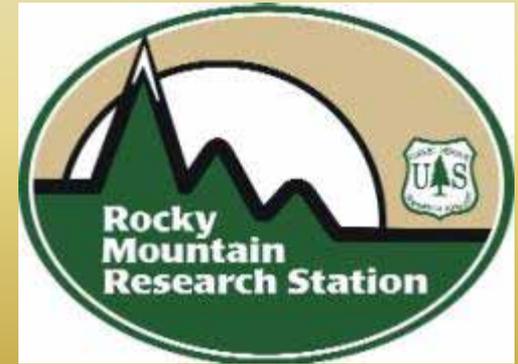
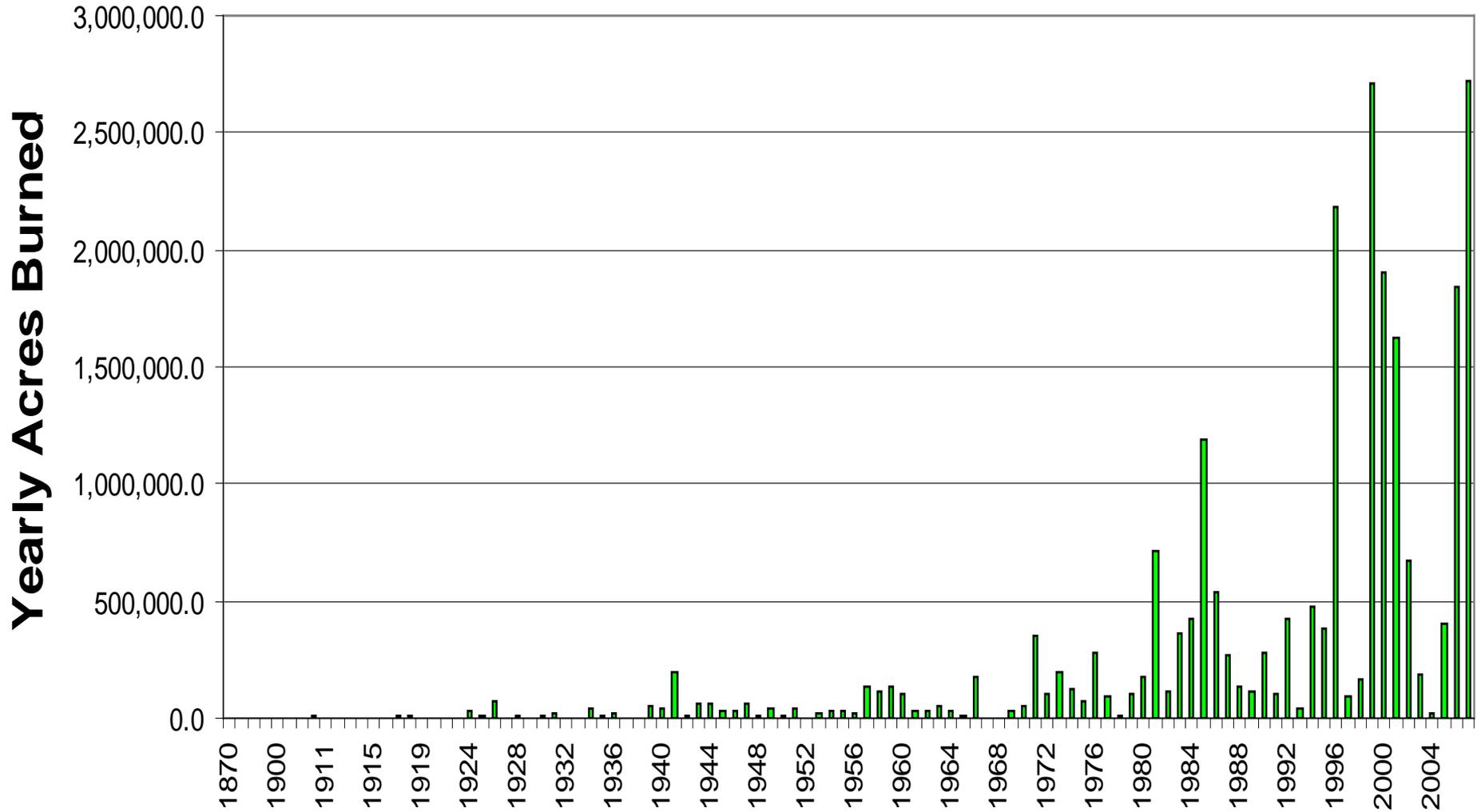


The Quest for Natives:
Selecting and
Growing Native Forbs
for Great Basin Restoration

Scott Jensen
RMRS GSD, Provo, UT.



Great Basin Fires: 1870-2007

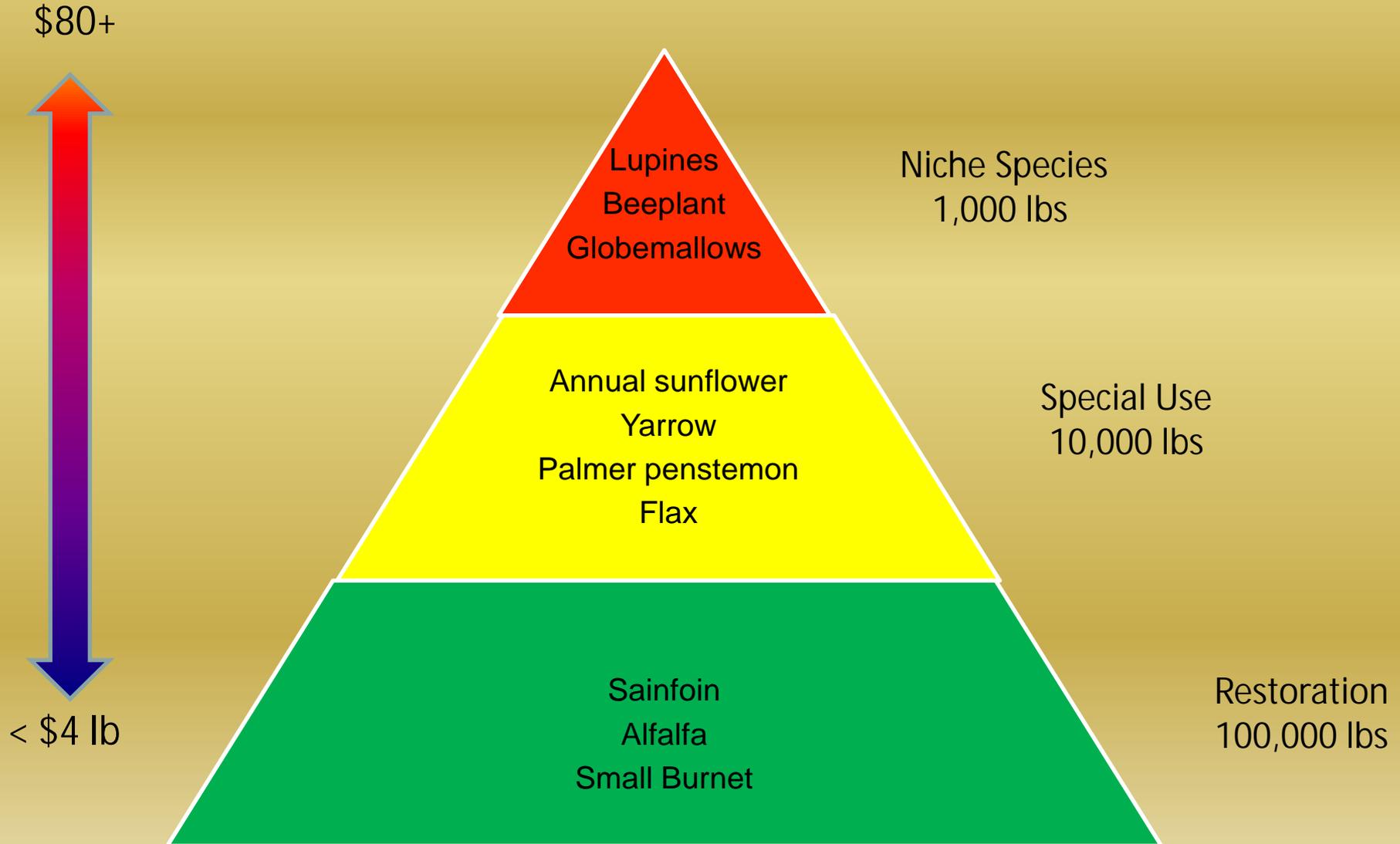




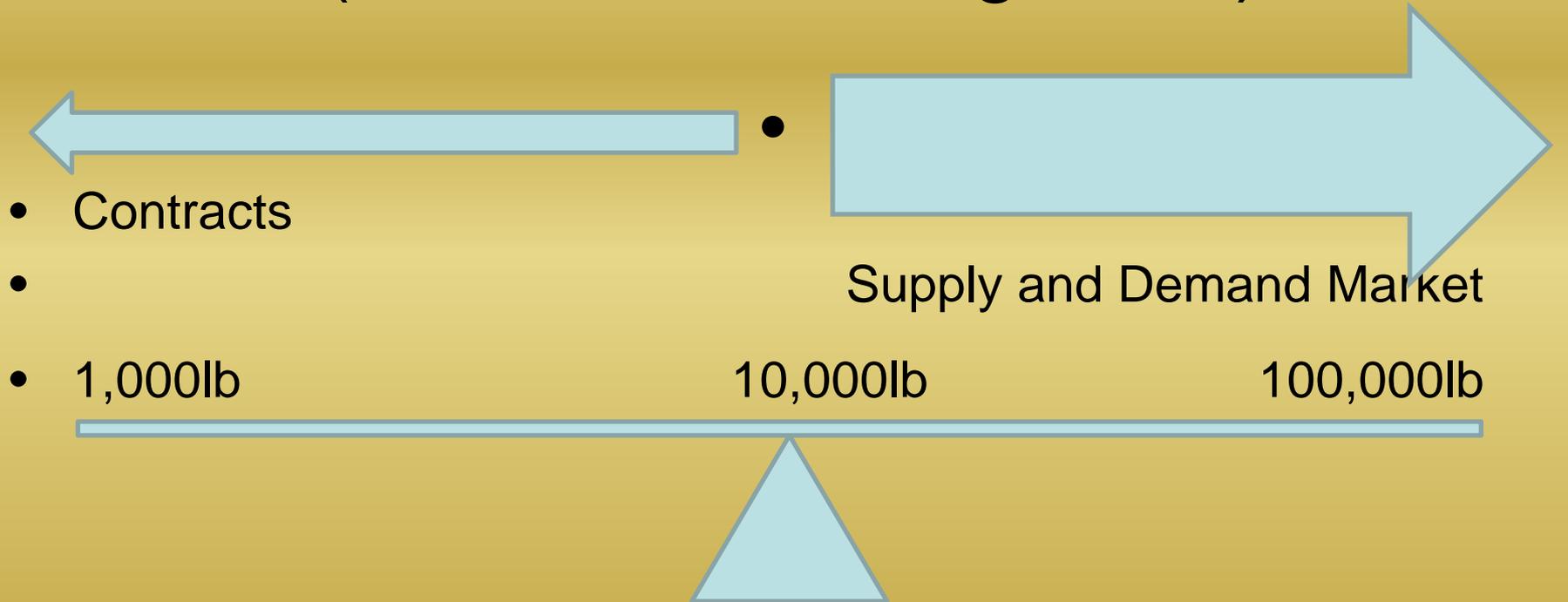
There are a plethora of plants on the landscape, which are good candidates for restoration?



Market Demand for Forbs



Dollars: Funding germplasm development and increase (i.e., seed on the ground)

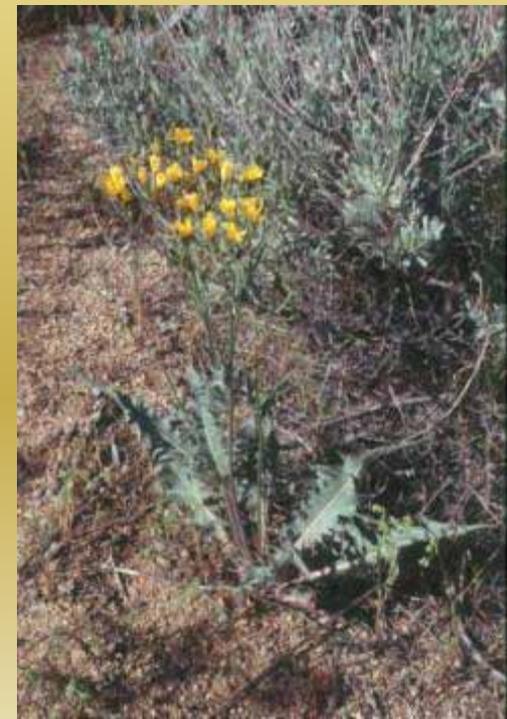


- For a healthy Great Basin seed market (availability and reasonable prices), plant 1,000,000 acres of shovel-ready projects per year (funding to come from re-directed fire budgets when no fires).
 - Stanford Young, UCIA, USU, Logan, UT

Desirable Attributes for Agronomic Production :

- Tall 1-3 ft. Upright growth habit
- Determinate flowering
- Good seed retention
- Abundant seed set
- Annually productive
- Easily established from seed
- Long lived
- Disease resistant
- Broad distribution

- Unavailable from wildland collections – 20lbs-\$250
- 3 years to establish
- Persist for at least 5 years once established
- Disease issues, very prone to insect damage in the seedling stage of development



Is there a replacement species ?

Species Screening



- **Agoseris**

- heterophylla
- aurantiaca
- grandiflora
- glauca

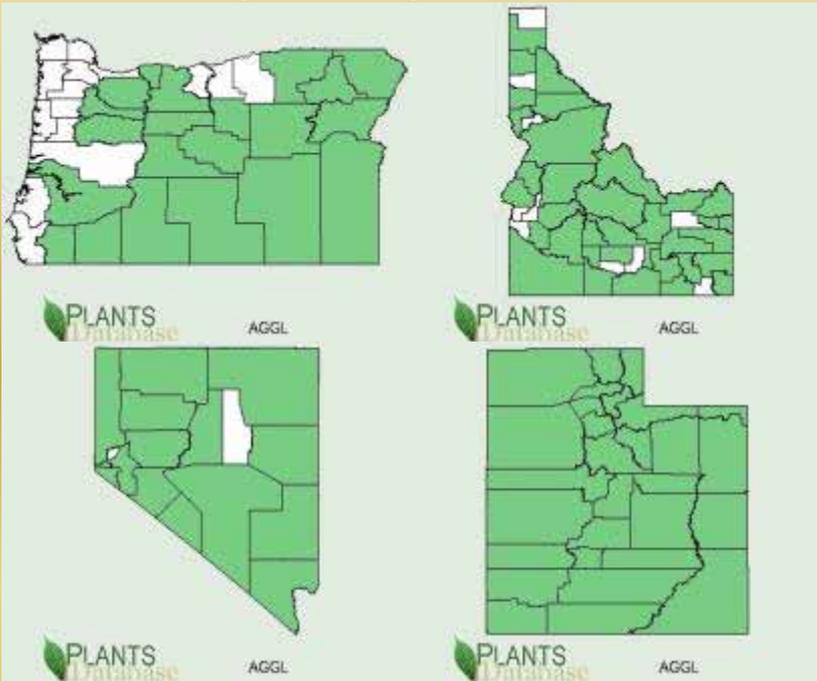


- **Traits**

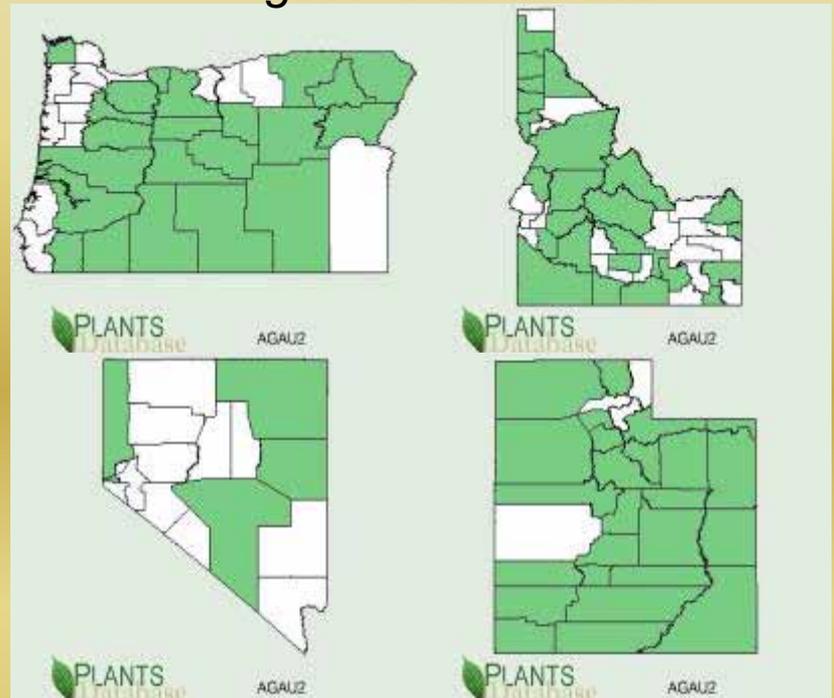
- 1-3 scapes
- Solitary heads
- Wind dispersed
- Flower can be extended with supplemental water



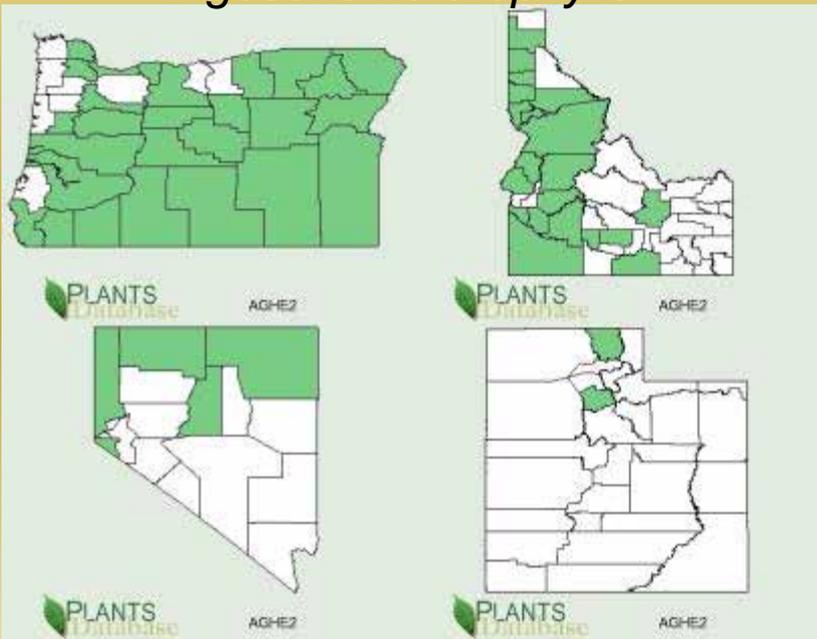
Agoseris glauca



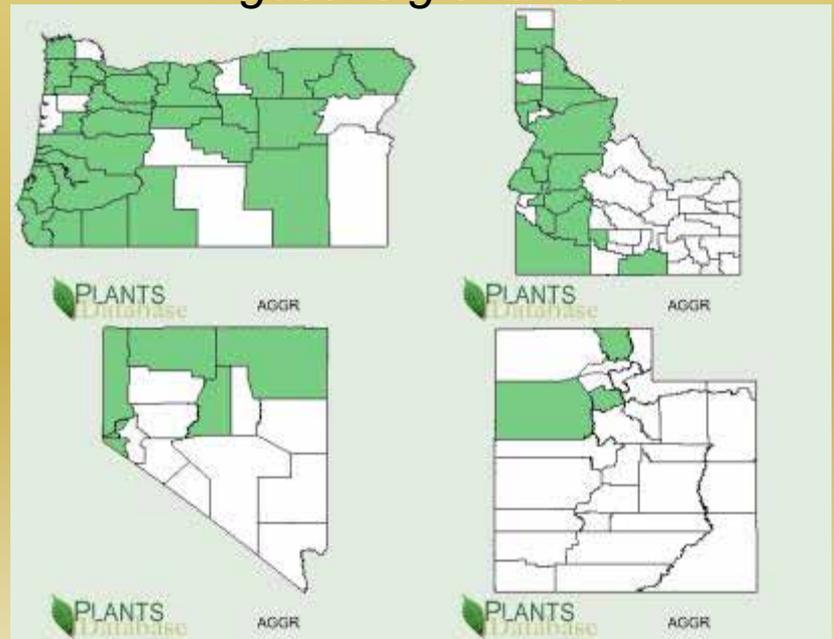
Agoseris aurantiaca

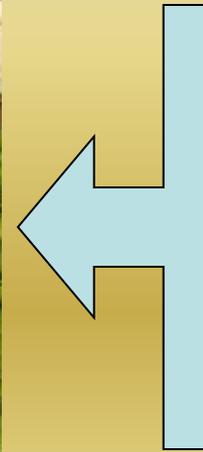


Agoseris heterophylla



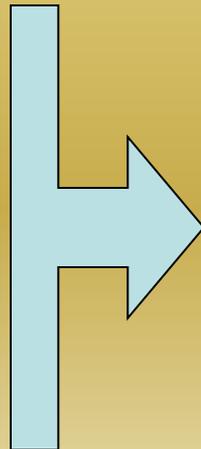
Agoseris grandiflora





Agoseris
- *heterophylla*
- *grandiflora*

Agoseris
- *glauca*
- *aurantiaca*



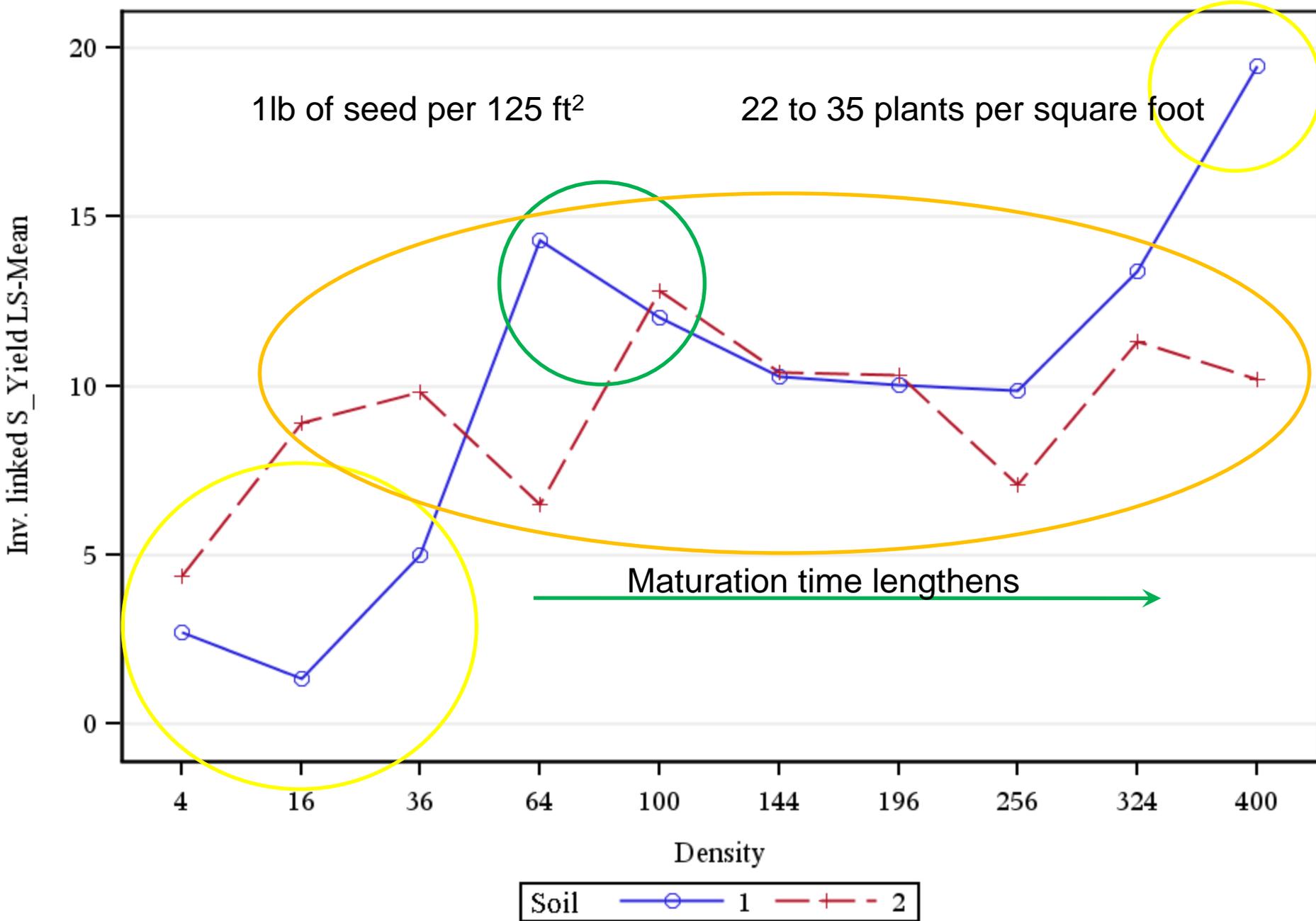
Agoseris grandiflora
Lucky Peak Nursery

125 lbs/acre

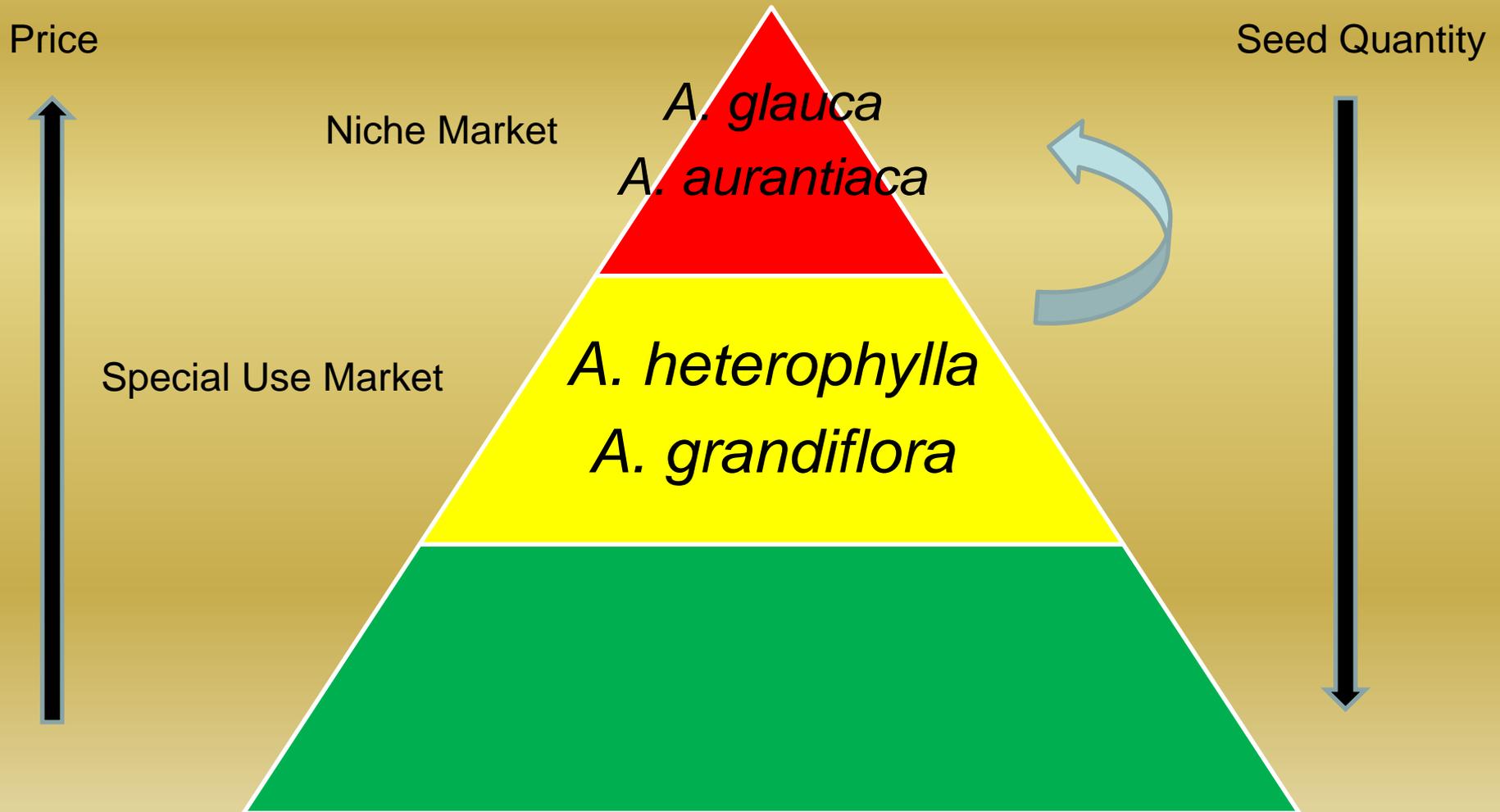




LS-Means for Soil*Density



Agoseris Production Categories



Species Screening

Lupinus

arbustus, *argenteus*
prunophilus, *sericeus*



Lupinus arbustus

16 pounds per acre from a 30% stand

50 pounds per acre from a 100% stand

Lupinus argenteus

35 pounds per acre

Lupinus sericeus

24 pounds per acre



Lupine Production Categories

L. argenteus

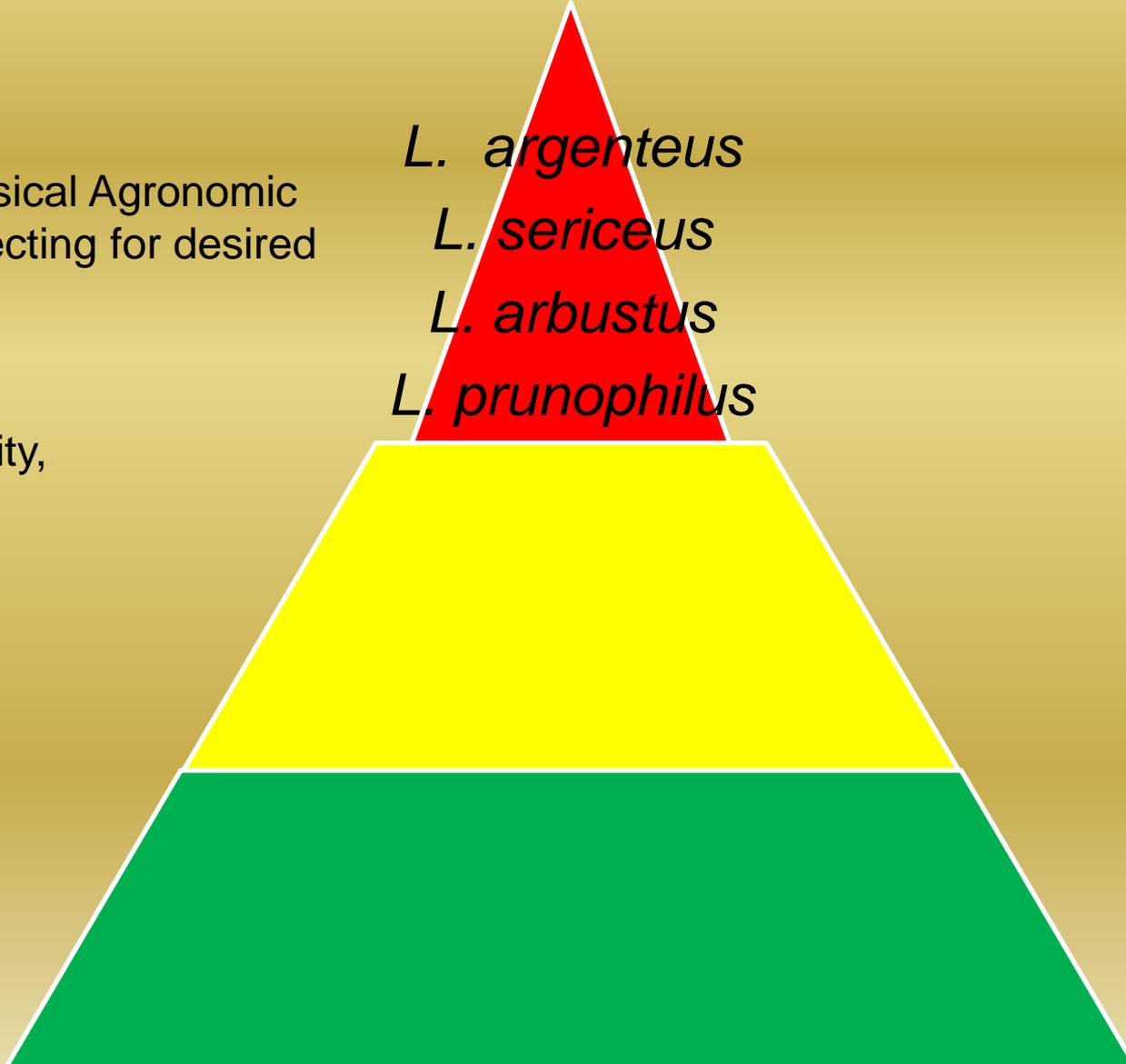
L. sericeus

L. arbustus

L. prunophilus

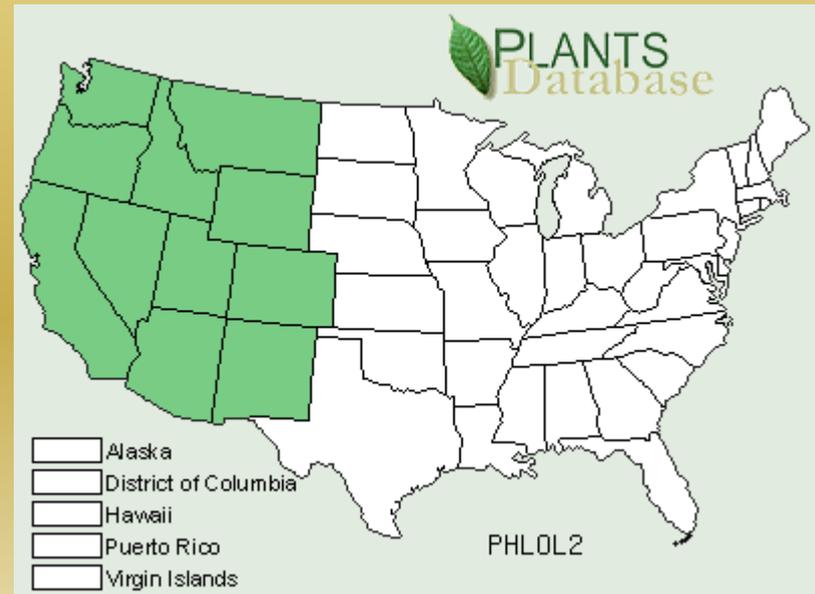
Employ the classical Agronomic approach to selecting for desired characteristics:

Superior yield,
ripening uniformity,
seed retention



Longleaf Phlox

Phlox longifolia



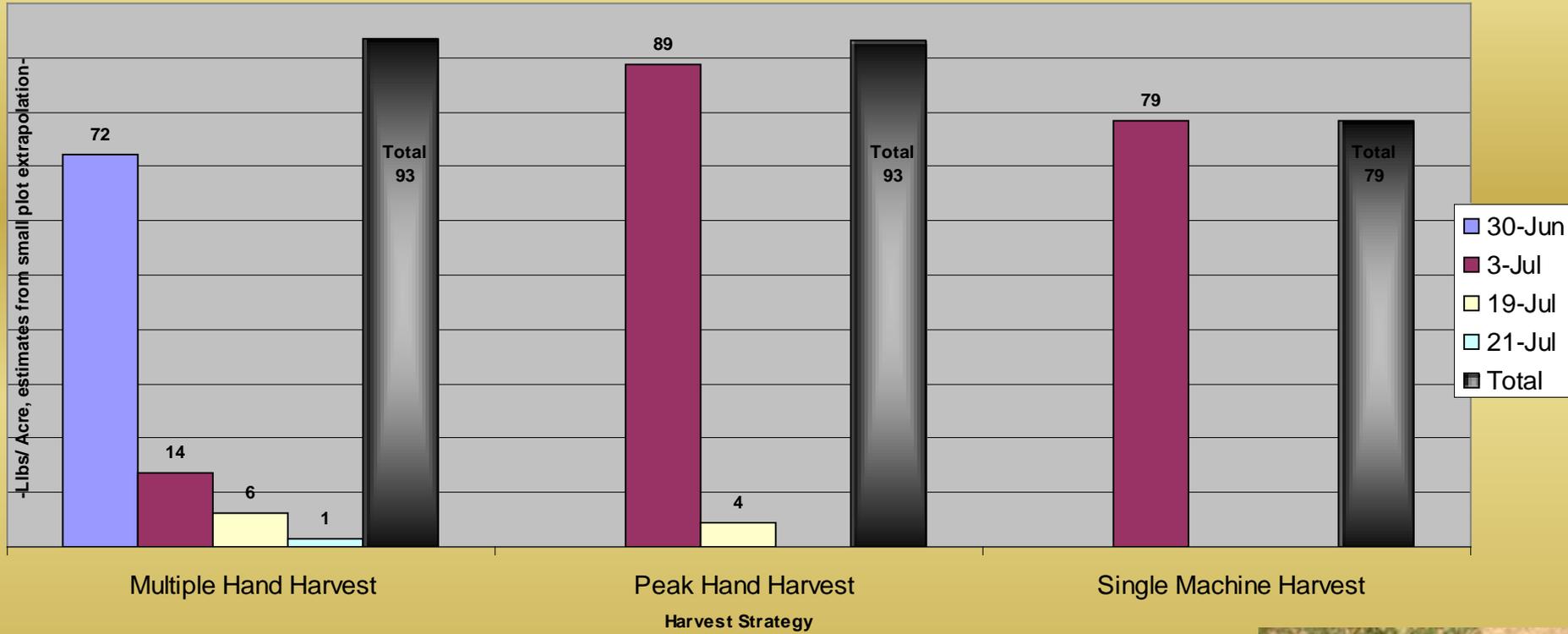
Species Screening

Ipomopsis aggregata

-a replacement for *Phlox longifolia*?



Estimated Seed Yield (lbs/acre) under Different Harvest Strategies for *Ipomopsis aggregata*, Ephraim UT. 2008



Soil Type Planting Depth Study

- Four soil types
 - Two typical agronomic soils
 - Clay loam, clay
 - Two typical wildland soils
 - 95% percent of forbs collected and in the data base are found in either loamy sand, or sandy loam
- Four planting depths
 - 0, 1cm, 2cm, 3cm
- 20 species

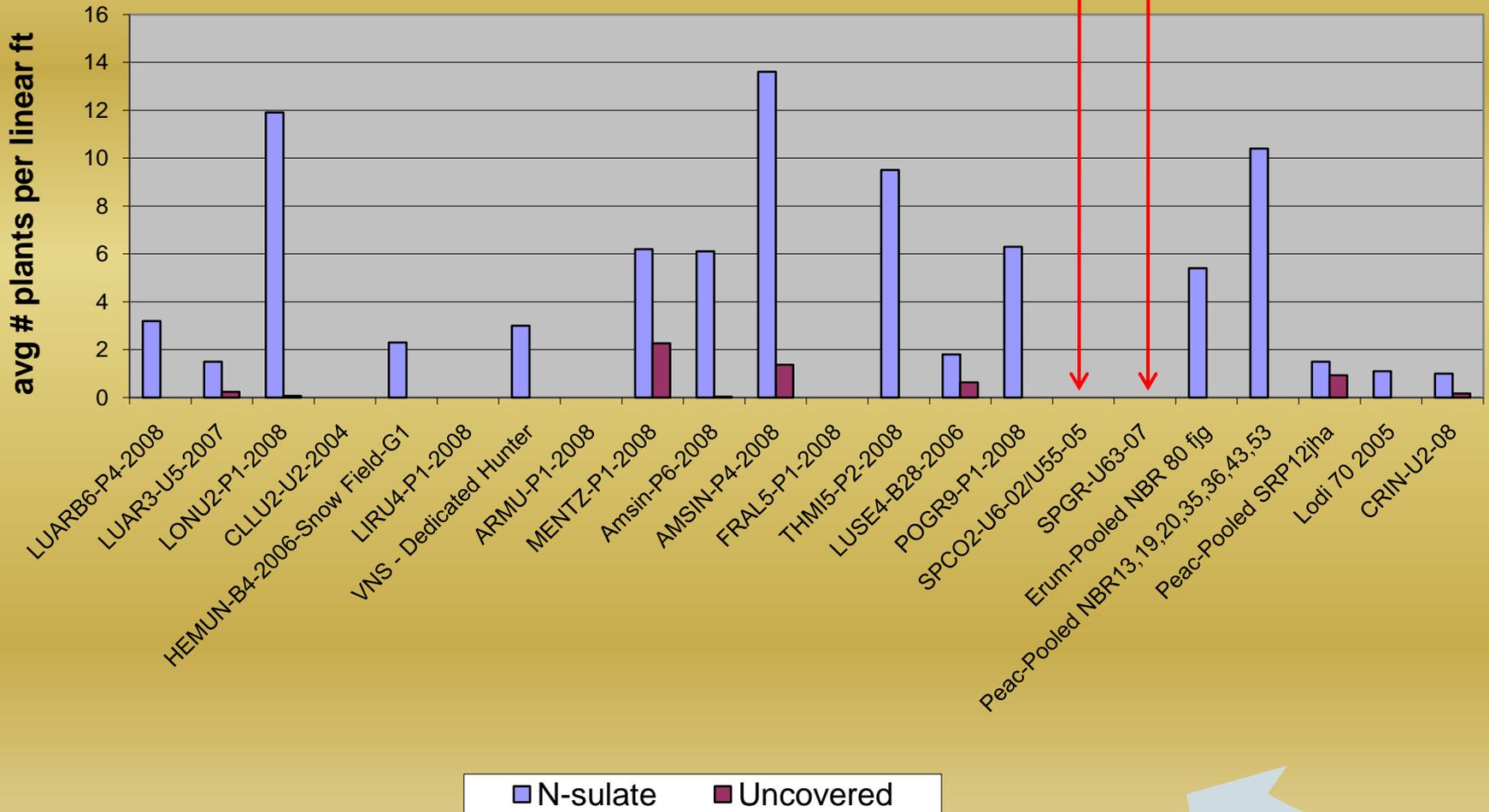




Cultural Practices



Seedling Establishment Spring Creek, NV. May 12, 2009



Cultural Practices

The Jet Harvester



NRCS Aberdeen PMC





Univerco - Eco Weeder



Soil Solarization



Disease Control
to 18", temperature dependant

Weed Control
Most effective against annual weeds
Cheeseweed (*Malv parviflora*)
Field bindweed (*Convolvus arvensis*)

Nematode Control
To 12", temperature dependant

Increased Plant Growth Response
Pathogen and weed control
Soluble nutrients more available
Beneficial bacteria survive and



Root Transplant Studies



A solution for species that require multiple years to produce their first seed crop?



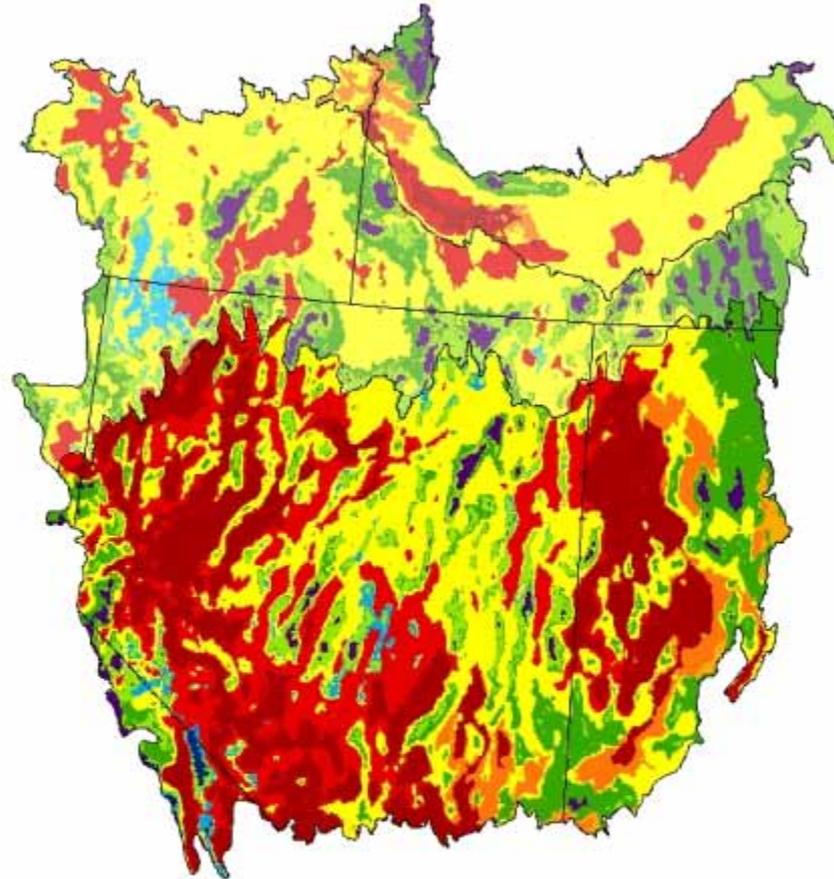
Colorado Native Plant Initiative

- Contribute to the increased availability of **regionally adapted** native plant materials for use in restoration of native plant communities.

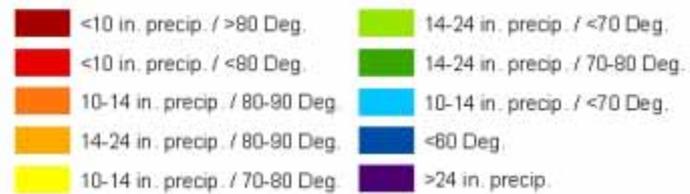
Provisional Seed Zones

- Applications
- Seed Increase

Great Basin Provisional Seed Zones



Provisional Seed Zones



Plant Materials Distribution by Seed Zone

Provisional Seed Zone	Rev_zone	Area (acres)	Collections	Sites
Zone 1	<10 in. precip. / >80 Deg.	18,989,233	50	281
Zone 2	<10 in. precip. / <80 Deg.	21,379,720	115	418
Zone 3	10-14 in. precip. / 80-90 Deg.	4,383,954	149	165
Zone 4	14-24 in. precip. / 80-90 Deg.	560,491	11	17
Zone 5	10-14 in. precip. / 70-80 Deg.	47,246,869	697	1361
Zone 6	14-24 in. precip. / 70-80 Deg.	16,780,791	478	867
Zone 7	10-14 in. precip. / <70 Deg.	2,608,648	24	59
Zone 8	14-24 in. precip. / <70 Deg.	9,107,002	86	317
Zone 9	<60 Deg.	225,219	0	20
Zone 10	>24 in. precip.	3,699,834	41	254
Total		124,981,760	1651	3759

Forecasting Priority Areas



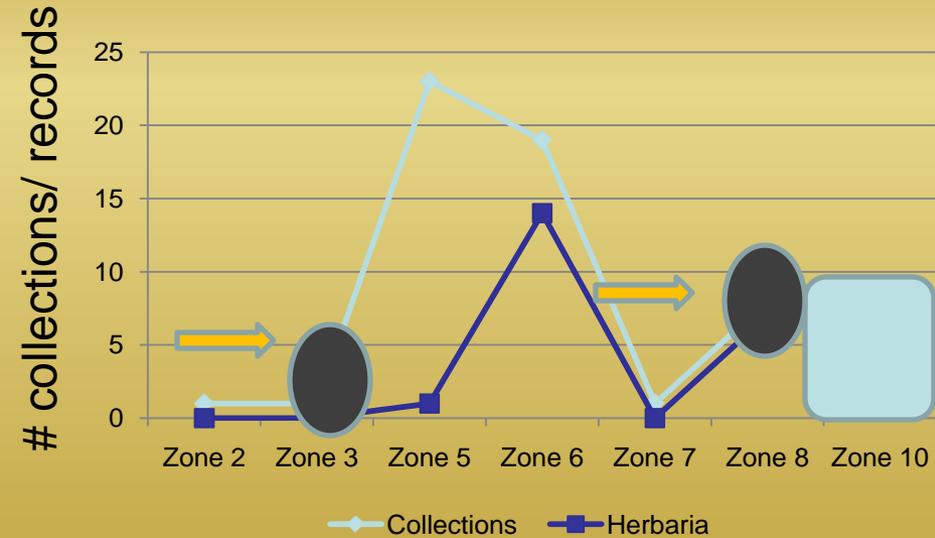
Database –
Compiled Agency
GIS layers of
reseeding efforts.

Distribution by Seed Zone

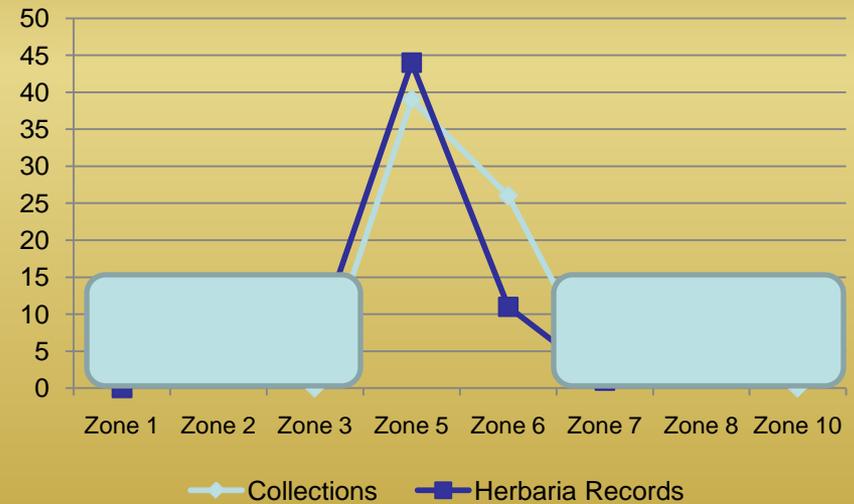
Species	Seed Zone	# Observations	% Herbaria
<i>Balsamorhiza hookeri</i>	2, 5, 6, 8	24	30%
<i>Balsamorhiza sagittata</i>	2, 3, 5, 6, 7, 8, 10	99	40%
<i>Cleome lutea</i>	1, 2, 3, 5, 8	60	90%
<i>Cleome serulatta</i>	1, 2, 3, 4, 5, 8	36	60%
<i>Crepis acuminata</i>	1, 3, 5, 6, 7, 8, 10	168	50%
<i>Crepis intermedia</i>	1, 3, 5, 6, 7, 8, 10	50	40%
<i>Enceliopsis nudicaulis</i>	1, 2, 3, 5	21	60%
<i>Heliomeris multiflora</i> var. <i>nevadensis</i>	1, 3, 5, 6, 8	17	20%
<i>Hesperostipa comata</i>	1, 2, 3, 5, 6, 8	296	60%
<i>Ipomopsis aggregata</i>	5, 6, 8, 10	42	60%
<i>Lomatium nudicaule</i>	1, 2, 5, 6, 8, 10	33	60%
<i>Lupinus argenteus</i>	1, 2, 3, 5, 6, 7, 8, 10	461	83%
<i>Lupinus sericeus</i>	2, 5, 6, 8, 10	13	65%
<i>Penstemon pachyphyllus</i>	2, 5, 6, 7, 8	59	50%
<i>Sphaeralcea grossulariifolia</i>	1, 2, 3, 4, 5, 6, 7, 8, 10	99	75%

Congruency Test

Balsamorhiza sagittata



Crepis accuminata



Acknowledgements

